

What is claimed is:

1. A method for sender-initiated credit recovery in a closed-loop credit based flow control system, the method comprising:

5 assigning a number of credits to a sender unit in the credit based flow control system;

 decrementing a credit count in the sender unit in response to the sender sending data to the receiver;

 incrementing the credit count in the sender unit in
10 response to receiving returned credits from the receiver unit;

 determining if a loss or gain in the number of credits in the closed-loop credit based flow control system has occurred;
 and

 adjusting the credit count based on the determined loss
15 or gain.

2. The method of claim 1 wherein each credit indicates an amount of data that the sender unit can send to a receiver unit.

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3. The method of claim 1 wherein determining if a loss or gain in the number of credits in the credit based flow control system has occurred comprises:

sending a credit check message from the sender unit to
the receiver unit;

initializing a counter with a number of outstanding
credits;

5 decrementing the counter based on a number of credits
returned from the receiver unit;

receiving, at the sender unit, a credit check return
message from the receiver unit that indicates that the value
of the outstanding credits counter is the loss or gain.

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4. The method of claim 3 wherein initializing the
counter includes initializing the counter upon sending the
credit check message from the sender unit to the receiver
unit.

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5. The method of claim 3 wherein adjusting the credit
count based on the determined loss or gain includes performing
a signed addition of the number of outstanding credits in the
counter and the credit count.

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6. The method of claim 3 wherein sending the credit check
message includes sending the credit check message in-band with
data.

7. The method of claim 3 where initializing the counter includes using the value of the credit count and the value of max credits determined by the position of the credit check message in a data stream.

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8. The method of claim 3 wherein decrementing the counter includes decrementing the counter by credits returned to the sender unit from the receiver unit between sending the credit check message and receiving the credit check return message.

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9. The method of claim 3 further comprising:

decrementing the counter by a number of credits returned in the credit check return message; and

incrementing the credit count by the number of credits
15 returned in the credit check return message.

10. The method of claim 3 further comprising:

decrementing the counter by a number of credits returned in the credit check return message.

20 11. The method of claim 3 wherein the credit check return message carries a count of unreturned credits equal to zero.

12. The method of claim 3 where the sending order of the credit check return messages and credit return messages from the receiver is maintained to the sender.

5 13. The method of claim 1 wherein the sender unit is a credit head end unit.

14. The method of claim 1 wherein the receiver unit is a credit queue end unit.

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15. A method for determining if an error in the number of credits in the credit based flow control system has occurred comprises:

receiving a credit check message from a sender unit at a
15 receiver unit;

sending a credit check return message from the receiver unit to the sender unit that indicates that the value of the outstanding credits counter is the error.

20 16. The method of claim 15 further comprising:

enqueueing data to a credit managed data queue upon arrival at the receiver unit; and

returning credits to the sender unit based on an amount of data dequeued from the credit managed queue.

17. The method of claim 15 further comprising
enqueuing the credit check message to a credit managed
queue in order of reception with the data, and

5 returning the credit check return message upon dequeue of
the credit check message.

18. The method of claim 15 wherein sending a credit check
return message includes sending a credit check return message
10 upon receiving the credit check message.

19. The method of claim 17 wherein the credit check
return message carries any previously unreturned credits for
dequeued data from the receiver to the sender unit.

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20. The method of claim 18 wherein the credit check
return message carries the number of unreturned credits in the
receiver unit, including the credit value of data in the queue
and any previously unreturned credits for dequeued data.

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21. The method of claim 17 further comprising:
returning unreturned credits for dequeued data before
sending the credit check return message with a count of
unreturned credits equal to zero.

22. A closed-loop credit based flow control system
comprising:

a sender unit configured to:

5 assign a number of credits in the credit based flow
control system;

decrement a credit count in response to the sender
sending data to a receiver unit;

10 increment the credit count in response to receiving
returned credits from the receiver unit;

determine if a loss or gain in the number of credits
in the credit based flow control system has occurred; and

adjust the credit count based on the determined loss
or gain.

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23. The system of claim 22 wherein each credit indicates
an amount of data that the sender unit can send to the
receiver unit.

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24. The system of claim 22 further configured to:
send a credit check message from the sender unit to the
receiver unit;
initialize a counter with a number of outstanding
credits;

decrement the counter based on a number of credits
returned from the receiver unit;

receive, at the sender unit, a credit check return
message from the receiver unit that indicates that the value
5 of the outstanding credits counter is the loss or gain.

25. The system of claim 22 further configured to
initialize a counter upon sending the credit check message
from the sender unit to the receiver unit.

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26. The system of claim 22 further comprising a receiver
unit, the receiver unit configured to:

receive a credit check message from the sender unit; and
send a credit check return message that indicates that a
15 number of outstanding credits.

27. The system of claim 26 wherein the receiver unit is
further configured to:

enqueue data to a credit managed data queue upon arrival
20 at the receiver unit; and

return credits to the sender unit based on an amount of
data dequeued from the credit managed queue.

28. The system of claim 26 wherein the receiver unit is further configured to:

enqueue the credit check message to a credit managed queue in order of reception with the data, and

5 return the credit check return message upon dequeue of the credit check message.

29. A system comprising:

one or more network devices including:

10 a sender unit; and

a receiver unit, wherein the sender is configured to:

assign a number of credits in the credit based flow control system;

15 decrement a credit count in response to the sender unit sending data to a receiver unit;

increment the credit count in response to receiving returned credits from the receiver unit;

20 determine if a loss or gain in the number of credits in the credit based flow control system has occurred; and

adjust the credit count based on the determined loss or gain.

30. The system of claim 29 wherein the receiver unit
configured to:

receive a credit check message from the sender unit; and
send a credit check return message that indicates that a
5 number of outstanding credits.

31. A computer program product, tangibly embodied in an
information carrier, for executing instructions on a
processor, the computer program product being operable to
cause a machine to:

10 assign a number of credits in the credit based flow
control system;

decrement a credit count in response to the sender unit
sending data to a receiver unit;

increment the credit count in response to receiving
15 returned credits from the receiver unit;

determine if a loss or gain in the number of credits in
the credit based flow control system has occurred; and

adjust the credit count based on the determined loss or
gain.

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32. The computer program product of claim 31 further
configured to:

receive a credit check message from the sender unit; and

send a credit check return message that indicates that a
number of outstanding credits.